Shared Information and Virtual Surfaces

Stephen C. Hayne
Cap Smith
Leo Vijayasarathy

Colorado State University
Computer Information Systems

© Dr. Stephen C. Hayne

Long Term Goals

- Investigate performance of self-synchronizing teams
- Understand how teams collaborate on a shared surface in situations characterized by high stakes, uncertainty and time pressure

© Dr. Stephen C. Hayne

Project Objective

- Validate Model:

  Team Recognition Primed Decision-Making

- Empirical investigation for validity of:
  - **Pattern Sharing of Cognitive Chunks**
  - **Negotiated Interrupts**

© Dr. Stephen C. Hayne

Research Plan

- Validate Model
  - **Do teams recognize patterns?**
- Intention Sharing
  - **Is real-time telepointing (gesturing) effective?**
- Sharing Representation
  - **Items vs. Chunks**
  - **Time Pressure**

© Dr. Stephen C. Hayne

Impact

- Attention Management
  - **Telepointing (gesturing) was found to be “distracting” for collaboration**
- Perception and Sharing of Patterns
  - Discrete “item” sharing gives higher performance
  - Cognitive “chunk” sharing yielded higher task performance, **even under time pressure**

© Dr. Stephen C. Hayne

Applications

- Potential transition to Dr. Jeff Morrison's Knowledge Desk Program at SSC.
- Findings applicable to the DARPA ITO Augmented Cognition program (BAA #01-38)
- DARPA Cognitive Information Processing Technology (BAA #02-21)

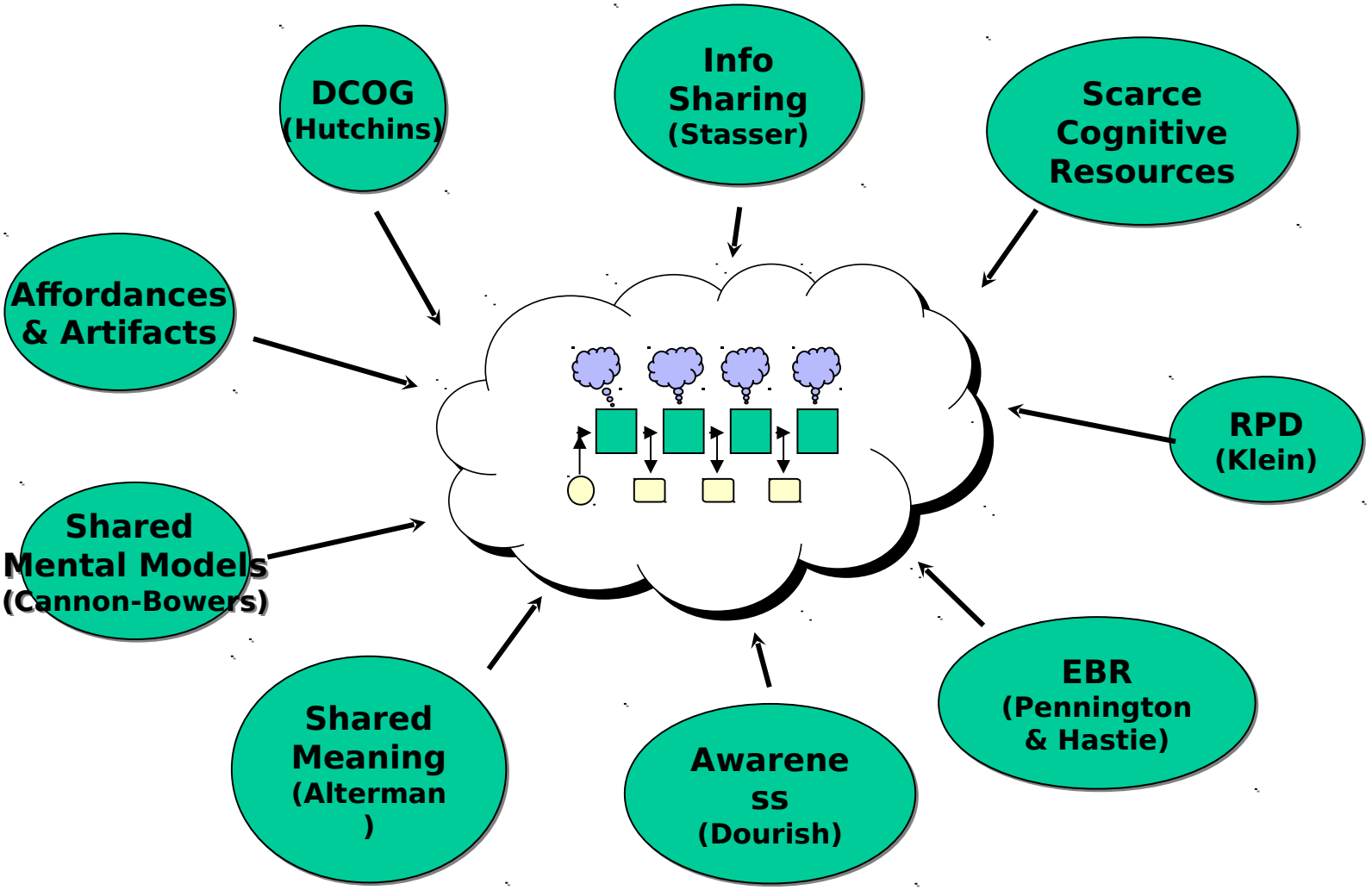
© Dr. Stephen C. Hayne

Cognitive Limitations

- **Perception**
- **Attention**
- **Memory**

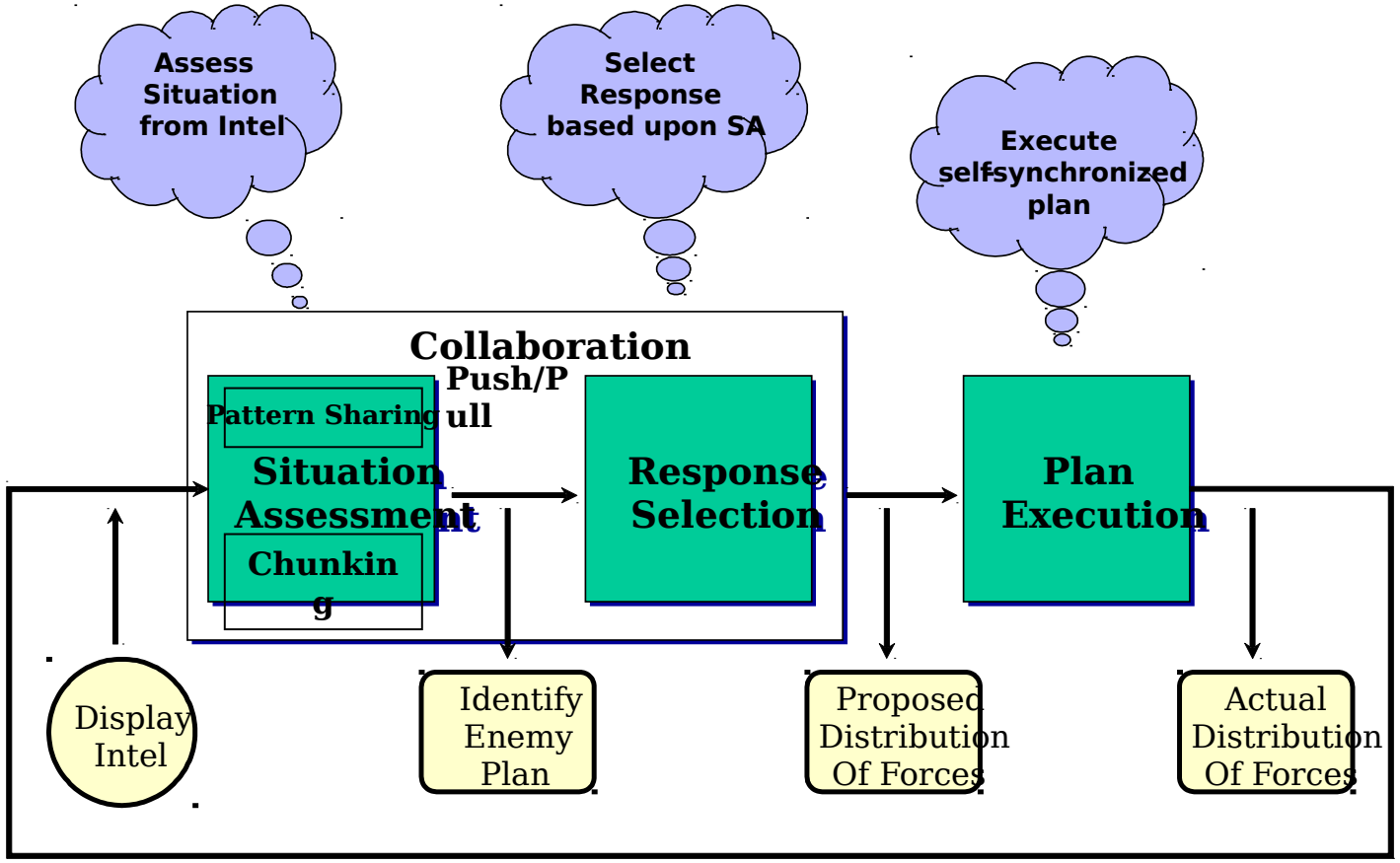
© Dr. Stephen C. Hayne

Cognitive Map



© Dr. Stephen C. Hayne

Research Model



Team Recognition Primed Decision Making

© Dr. Stephen C. Hayne

Hypotheses (3 year)

- **Teams using a compensatory aid for pattern-recognition tasks will outperform teams who do not.**

- Teams using negotiated interrupts with each other for pattern-recognition tasks will outperform teams who do not.

- Teams who learn patterns in the same way will outperform teams who do not.

© Dr. Stephen C. Hayne

FY '02 Research Plan

- Explore sharing of pattern chunks
  - **Labels**
  - Templates (slots)
- Rewards for **speed** and **accuracy**

© Dr. Stephen C. Hayne

Team Compensatory Aids

- **Perception** Tools for
  - ***Pattern Recognition***
  - ***Sharing of Intention***
- **Attention** Tools for
  - ***Telepointing/Gesturing***
  - ***Awareness***
  - Alerting (negotiated)
- **Memory** Aids for
  - Mitigating the Effects of Stress

© Dr. Stephen C. Hayne

Research Measures

- Outcome Measures:
  - *Quality*
  - *Speed*
- Process Measures:
  - *Pattern Recognition (Confidence)*
  - *Pattern Sharing*
  - *Collaboration*
    - *collisions, bumps, leaders, structures*

© Dr. Stephen C. Hayne

Current Progress

- Recent Data Collected:
  - Chunking (48 subjects)
  - Chunking Time Pressure (42 subjects)
- Analysis Performed

- International Journal of Human Computer Studies
  - first article from last year's results accepted.

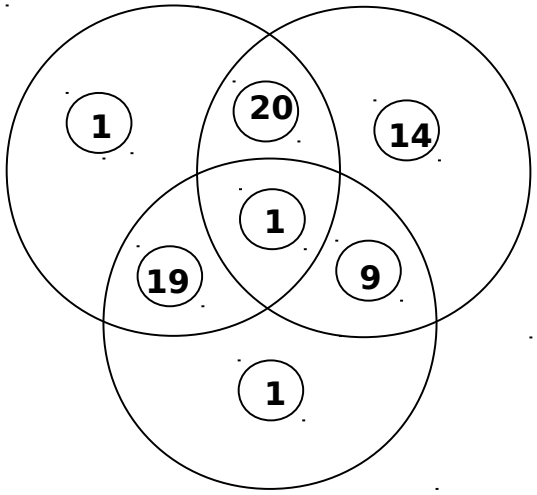
© Dr. Stephen C. Hayne

Decision Game

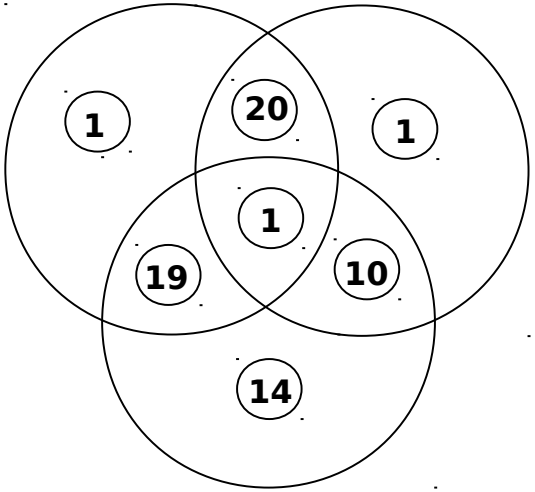
- Cooperative 3-Player Game
- Each player has 7 Tokens (numbered 1-7)
- Opponent has asymmetric force
  - Patterns: Definitive, Equivocal, Uncertain
- Team places tokens so total >= opponent
- Incentive
  - For total points
  - For time of play
- Play is interactive

© Dr. Stephen C. Hayne

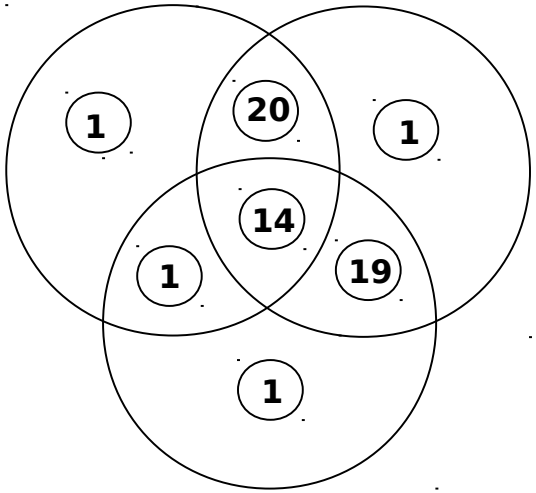
Patterns



9



10



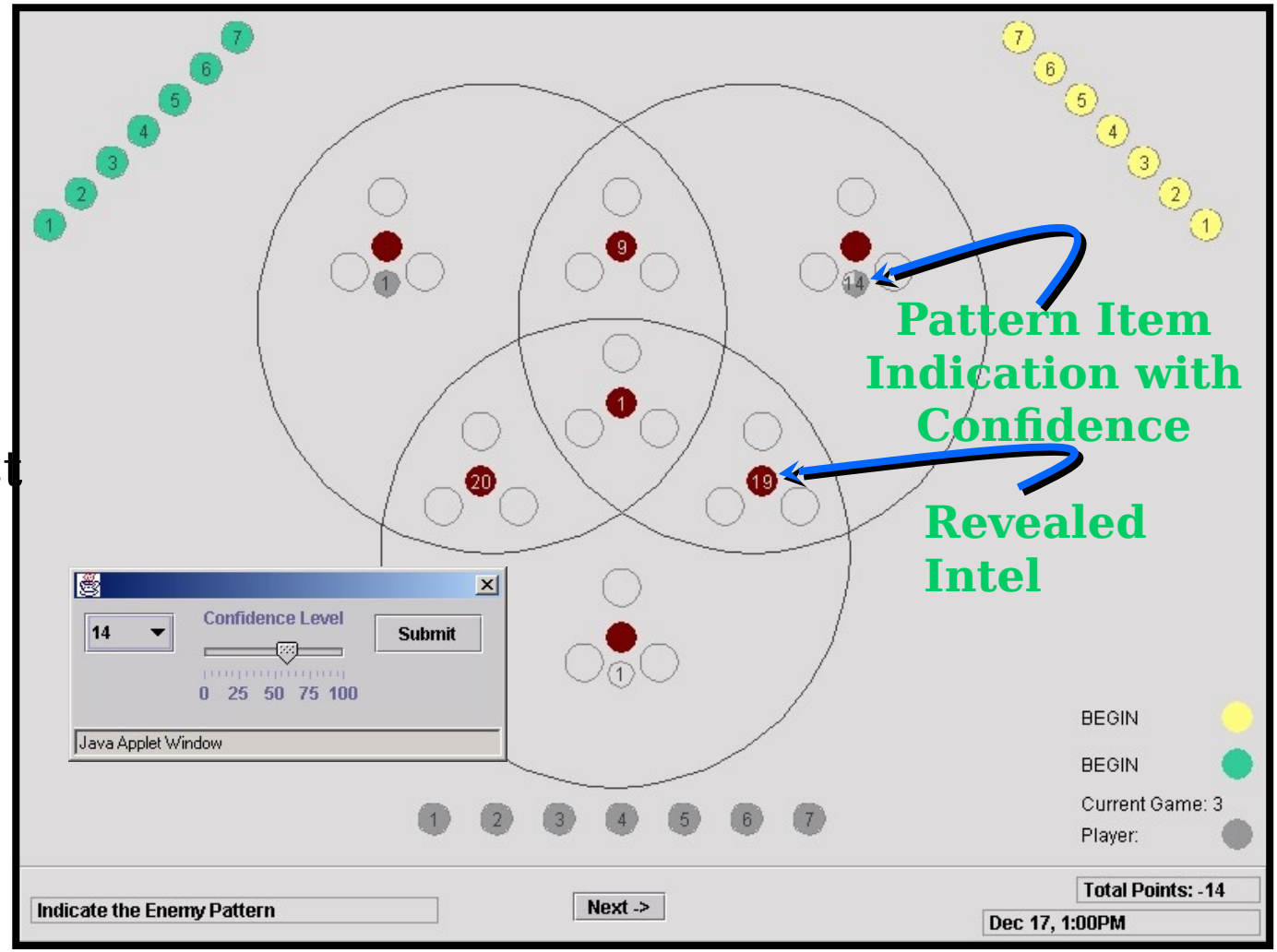
14

Chunk Labels

© Dr. Stephen C. Hayne

Pattern Items

Sockets
SQL
RMI
Multicast

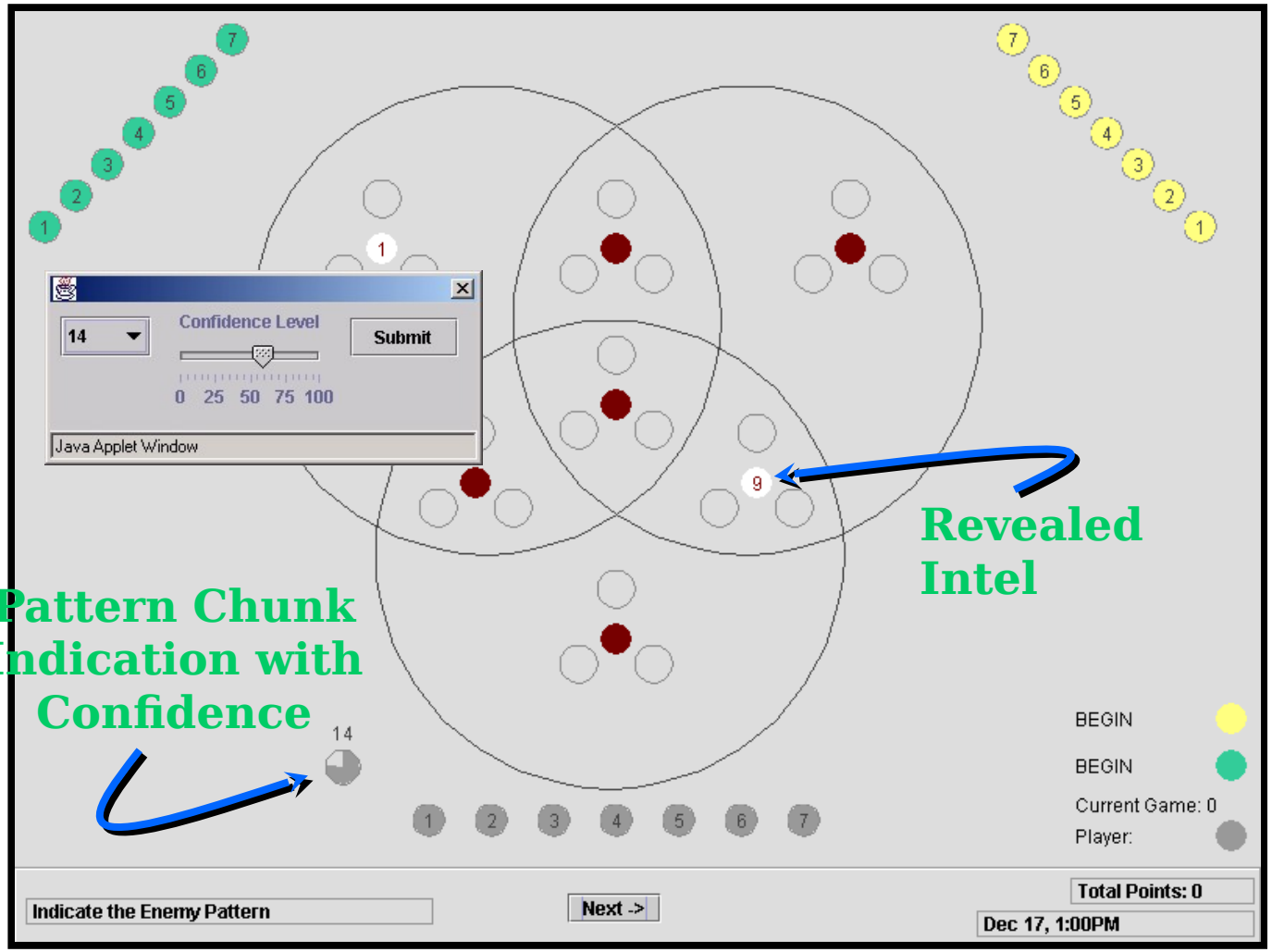


Shared Data Toolkit

XIS…

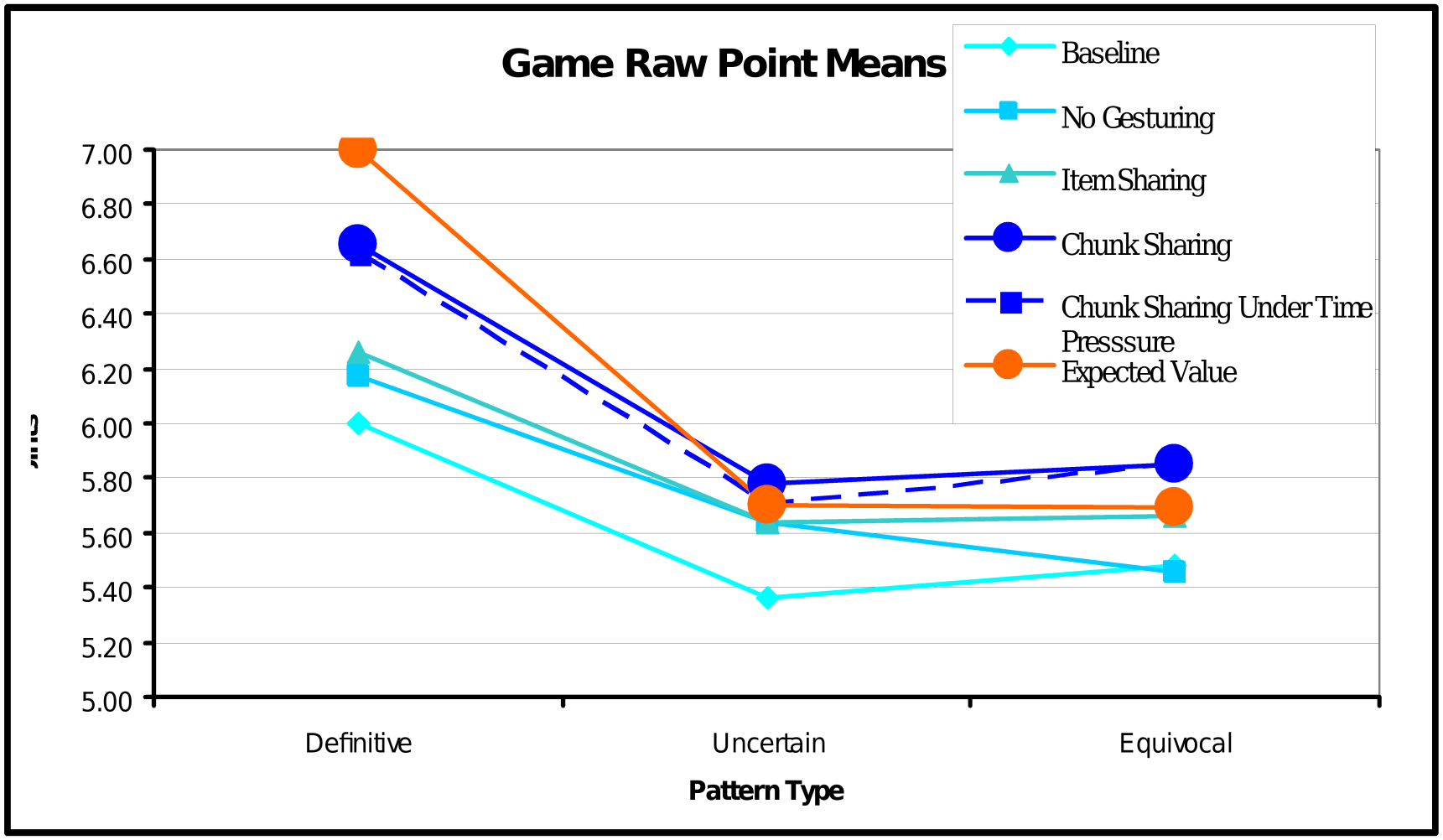
© Dr. Stephen C. Hayne

Pattern Chunks



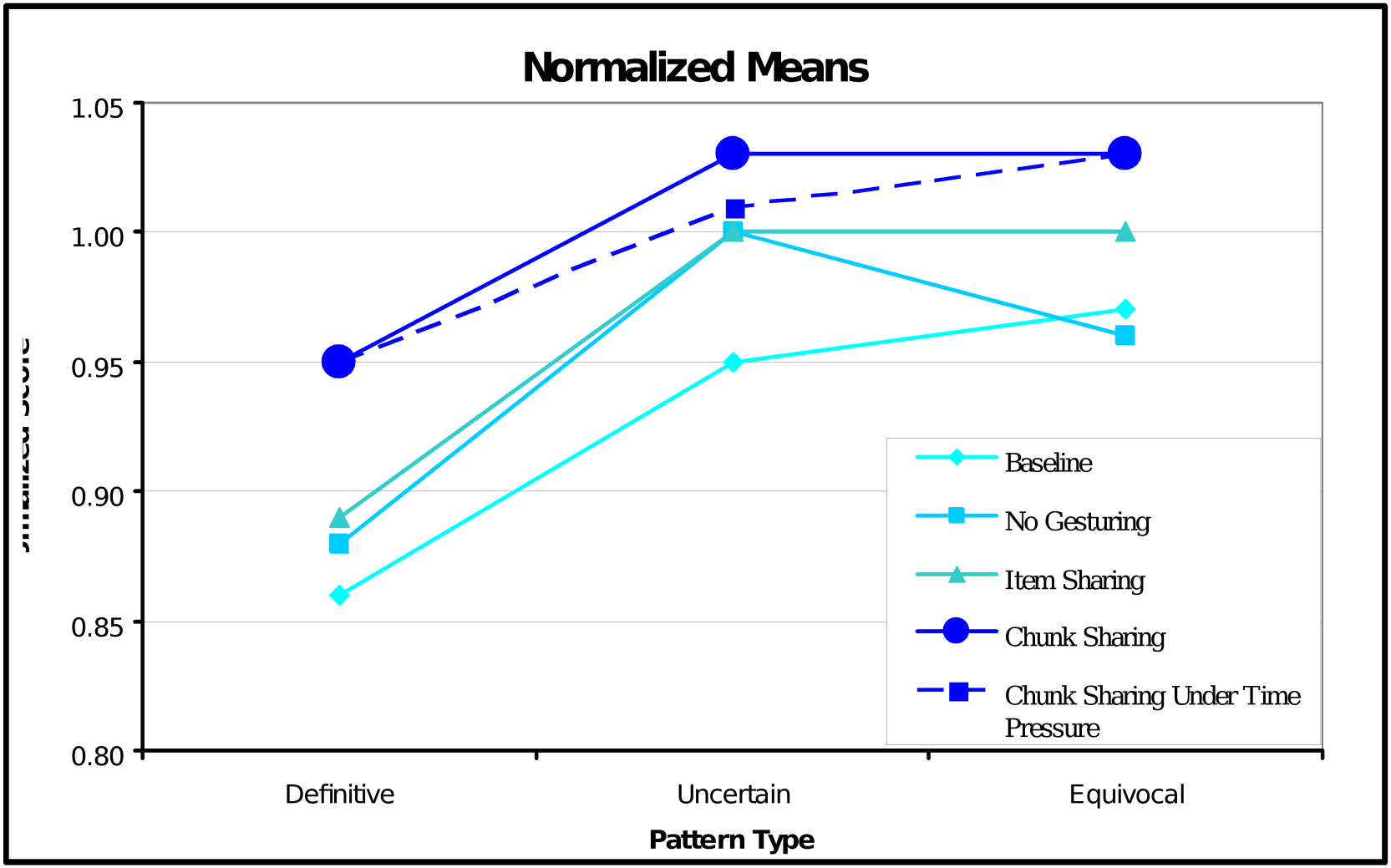
© Dr. Stephen C. Hayne

Raw Scores



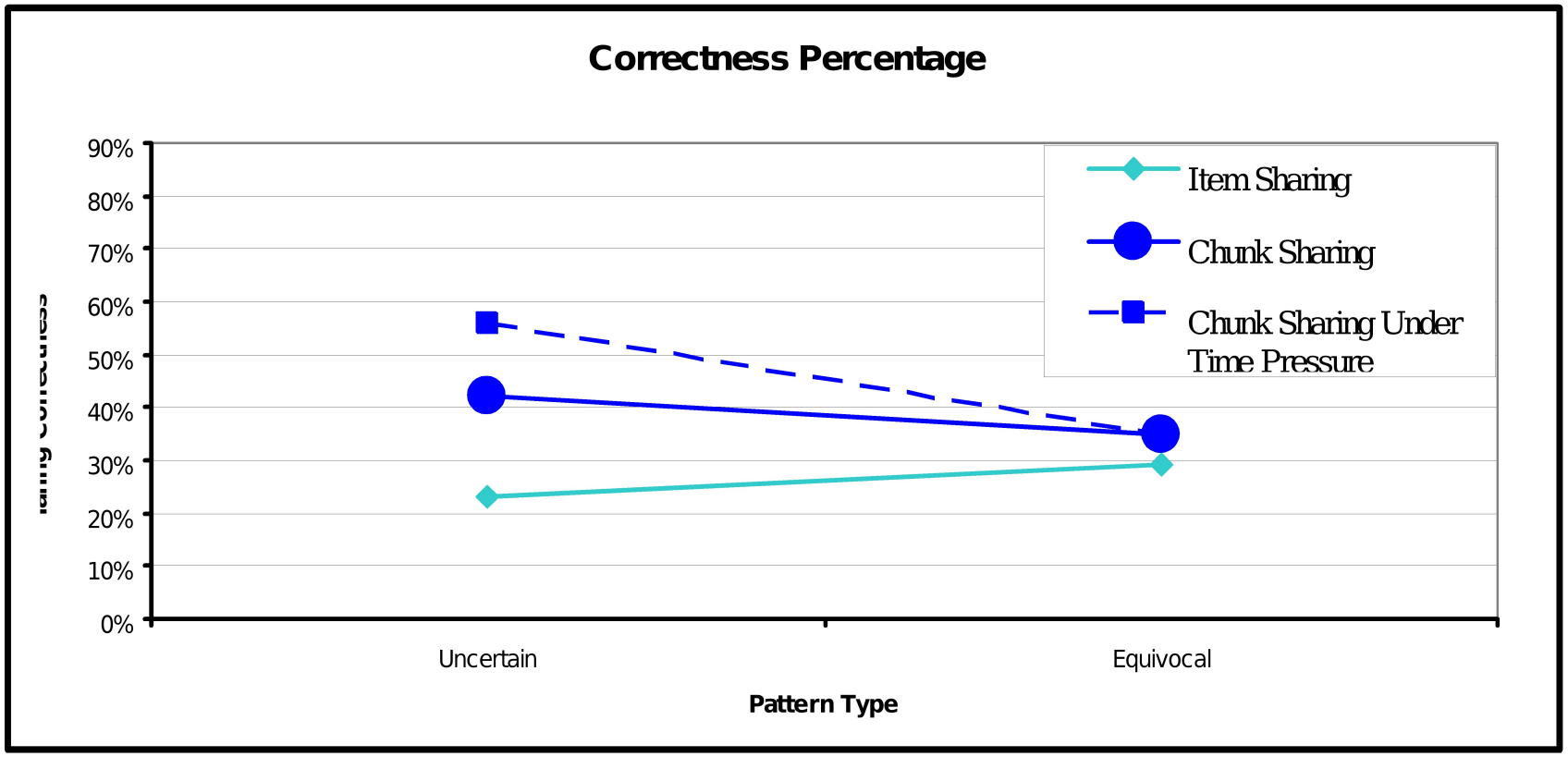
© Dr. Stephen C. Hayne

Normalized Scores



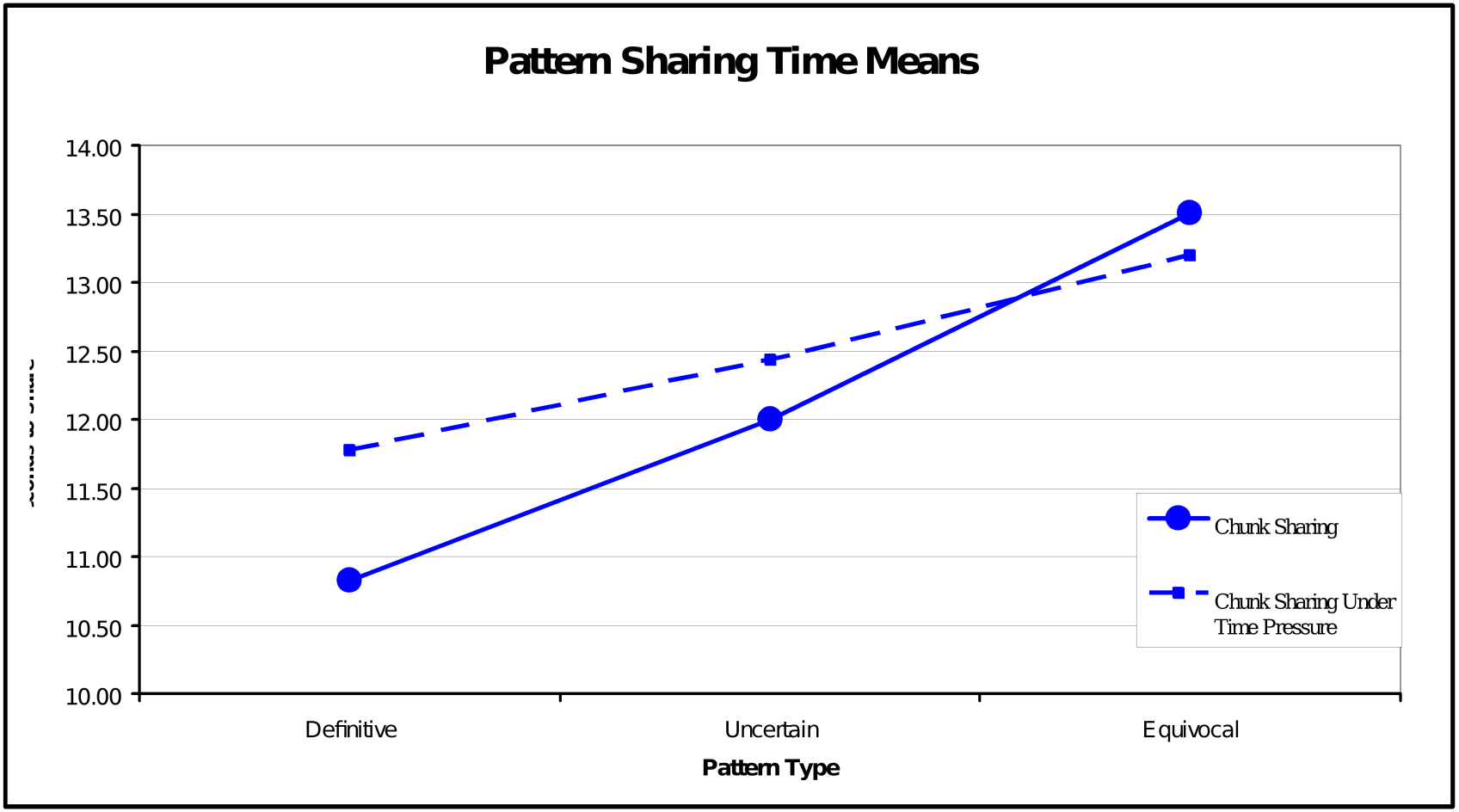
© Dr. Stephen C. Hayne

Sharing Correctness



© Dr. Stephen C. Hayne

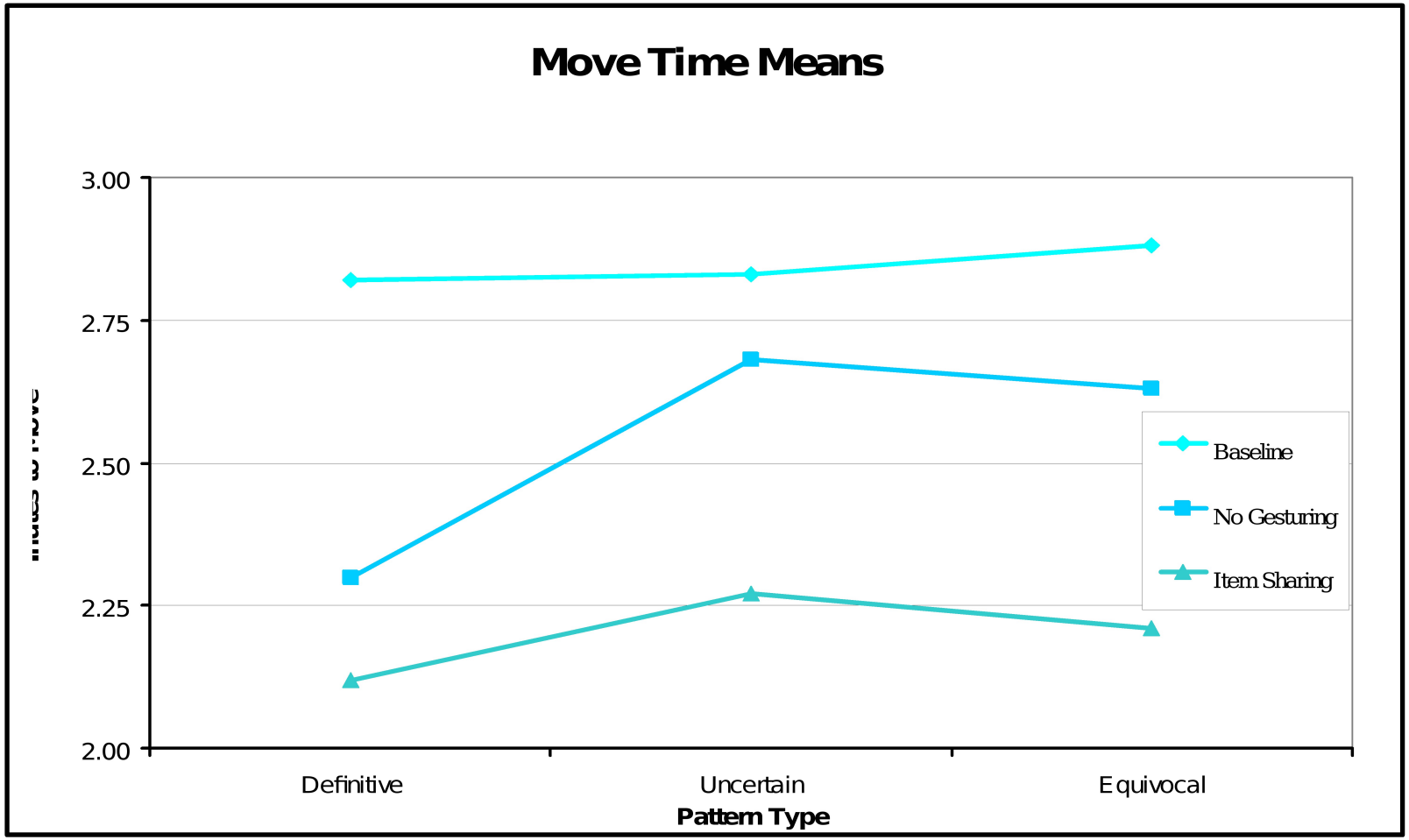
Pattern Sharing Time (Seconds)



No time pressure when sharing…

© Dr. Stephen C. Hayne

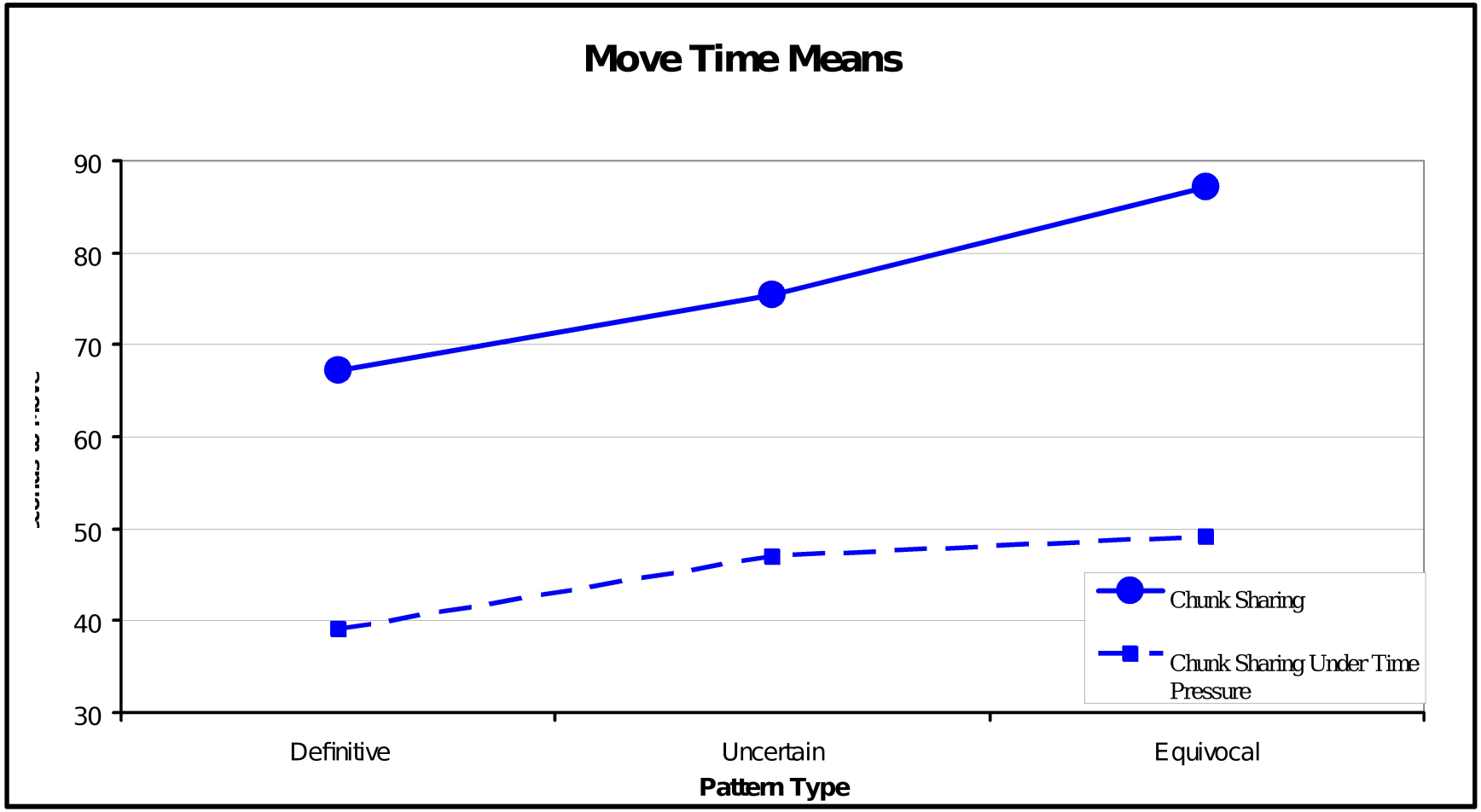
Move Time



No time pressure when moving…

© Dr. Stephen C. Hayne

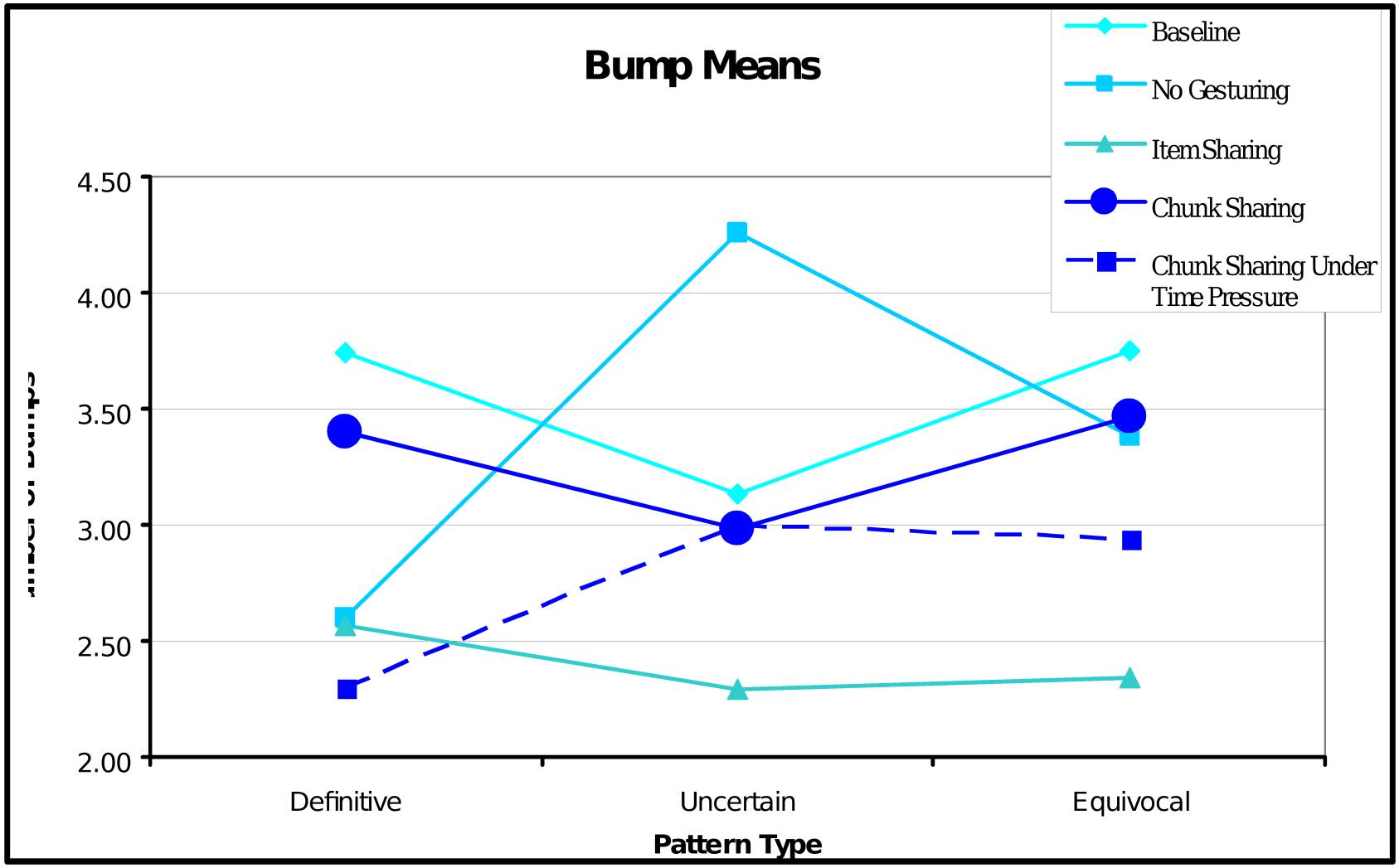
Move Time (Seconds)



Time pressure when moving…

© Dr. Stephen C. Hayne

Bumps



© Dr. Stephen C. Hayne

Conclusions

- Team Recognition Primed Decision Making Model Continues to be Validated
- Sharing of Pattern **Chunks** Improves Performance
  - Cognitive Alignment
  - Ultra Thin tool

© Dr. Stephen C. Hayne

Cleanup for FY 2002

- Protocol Process Analysis
  - Who's doing the bumping?
    - Detailed process analysis is required and ongoing
  - Emergent Leadership under Time Pressure?
    - Consistent leader and followers
  - Stimulating Structures
    - Moves of the 7,6 and 1 chips

© Dr. Stephen C. Hayne

FY 2003 Plans and Onward

- Change task domain (increase complexity)
  - Team Chess (expert chunk sharing)
    - Gobet/Simon (wants to explore CHREST)
    - Geo-Space, Power, Role, Hierarchy
  - Dynamic pattern recognition
  - Open Source Data
- Manipulate the ability of team members to "push" or "pull" pattern information from their teammates (negotiated interrupts)
- Sudden Insight Signal in conjunction with gaze

© Dr. Stephen C. Hayne